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July 3, 2000

NEW APPLICATION TRANSMITTAL

Docket No. ENG901US

Box Patent Application
Hon. Commissioner of Patents and Trademarks
Washington, DC 20231

Dear Sir:

Transmitted herewith for filing is the patent application of
Goran E. Enhorning

For:

PIPETTE HAVING A SMALL VOLUME DISPOSABLE TIP

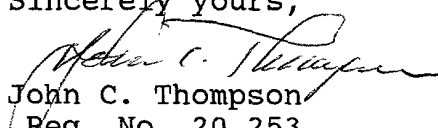
This new application is for a non-provisional patent application, the application including 8 pages of description, 1 page of claims, 1 page of abstract, a combined declaration and power of attorney, and 4 sheets of drawings. This application is not assigned.

Also enclosed are the following:

- A verified statement claiming small entity status;
- A check for \$345.00 for the filing fee; and
- A postcard for early notification of the serial no.

A prompt action on the merits of this application is respectfully requested.

Sincerely yours,

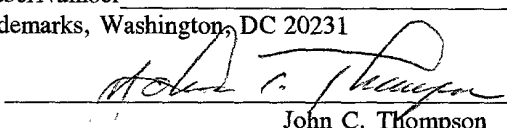

John C. Thompson
Reg. No. 20,253

I hereby certify that this New Application Transmittal and the documents referred to as enclosed therein are being deposited with the United States Postal Service on this date July 3, 2000 in an envelope

as "Express Mail Post Office to Addressee", Mailing Label Number

EK673536825US

addressed to the: Commissioner of Patents and Trademarks, Washington, DC 20231


John C. Thompson

**VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS
- INDEPENDENT INVENTOR -**

As a below named inventor, I hereby declare that:

I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled **PIPETTE HAVING A SMALL VOLUME DISPOSABLE TIP** described in the specification filed herewith.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed or licensed or am under an obligation under contract or law to assign, grant, convey or license any rights in the invention is listed below:

☐ no such person, concern or organization

☐ persons, concerns or organizations listed below*

*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27).

FULL NAME: _____

ADDRESS: _____

☐ INDIVIDUAL

☐ SMALL BUSINESS CONCERN

☐ NONPROFIT CORPORATION

FULL NAME: _____

ADDRESS: _____

☐ INDIVIDUAL

☐ SMALL BUSINESS CONCERN

☐ NONPROFIT CORPORATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Goran E. Enhorning
Name of inventor

Signature of inventor

Date _____

PIPETTE ASSEMBLY HAVING A SMALL VOLUME DISPOSABLE TIP

TECHNICAL FIELD

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The present invention relates generally to pipettes, and more particularly to a pipette assembly having a suction device and a small volume disposable tip having a capacity with a range of 0.1 μ l to 2.0 μ l, the disposable tip being removably secured to the suction device.

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BACKGROUND OF THE INVENTION

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In molecular biology, and in other fields, pipette assemblies having small volume disposable pipette tips are used. These pipette assemblies basically consist of two parts, one part being a pipette body or suction device (similar to a syringe) and the other being the disposable pipette tip. With the suction device an exact amount of vacuum is produced. The disposable pipette tip is tightly attached to the suction device, and the vacuum produced by the suction device sucks a predetermined volume of liquid into the second part. Such tips are shown in EP 0 743 095 A1, as well as numerous other patents. One commercially available pipette assembly is the Gilson Pipetman® P-2 model which is provided with a disposable tip having an advertised range of 0.1 - 2.0 μ l. According to their advertisement, there is minimal air space between the piston in the suction device and the sample which makes the results less technique-dependant. However, with the P-2 model, there is an advertised mean error of $\pm 12\%$ at 0.2 μ l. It is believed that the mean error is due in part to the construction of the disposable tip which is a female part that telescopes over a male part of the suction device. The disposable tip is injected molded and, because it has

to go outside the male part, it is rather wide and has a large volume, usually more than 30 μl .

OBJECTS AND SUMMARY OF THE INVENTION

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It is an object of the present invention to provide a pipette assembly employing a disposable tip which may be used with very small samples in the range of 0.1 - 2.0 μl with a high degree of accuracy.

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It is a further object of the present invention to provide such a pipette assembly wherein the disposable tips are of low cost.

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In summary, the pipette assembly of this invention includes a suction device provided with a female tip receiver, which receives a disposable male tip in the form of a short piece of extruded tubing. The tubing has a very small i.d., for example 0.3 mm. It is preferably formed of Teflon®, or another hydrophobic material. This arrangement has three advantages:

- 1) The volume of air in the tip can be very small (circa 3 μl) which makes it easier to exactly determine the volume of liquid that is sucked into the tip. The larger the air volume the greater is the risk that the vacuum will thin the air whereby the volume of sample liquid will be reduced. This is of particular importance if the liquid has a high viscosity.
- 2) The disposable tip, i.e., the short piece of extruded tubing, is extremely inexpensive. The volume of plastic used for the tip is very small and although a new tip is used for each sample the volume of plastic consumed is reduced.
- 3) The material of the tip can be Teflon® or another hydrophobic material. This reduces the risk that any of the sample liquid will remain in the tip after extrusion of the sample.

The forgoing objects and other objects and advantages of this invention will be apparent to one skilled in the art after a consideration of the following detailed description taken in conjunction with the accompanying drawings in which preferred forms of the invention are illustrated.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial cross-section of a first pipette assembly of this invention, this first embodiment including a disposable pipette tip carried by a suction device.

FIG. 2 shows the disposable tip which is in the form of a cut-off male part. The tip, a short piece of an extruded tubing, is shown to the right, ready to be attached by being pushed into the suction device's funnel shaped opening.

FIG. 3 is a view similar to FIG. 2 showing the relationship of the parts after the disposable tip has been attached.

FIG. 4 shows the parts after the piston of the suction device, a thin stainless steel wire, has moved to the left whereby the vacuum produced has sucked a sample into the tip, the sample volume being in the range of 0.1 - 2 μ l.

FIG. 5 is a partial cross-section of a second pipette assembly of this invention, this second embodiment also including a disposable pipette tip and a suction device which carries the disposable pipette tip.

FIG. 6 is an enlarged sectional view of a portion of the assembly shown in FIG. 5.

FIG. 7 is an exploded view of the suction device shown in FIG. 5.

DETAILED DESCRIPTION

In the accompanying drawings the pipette assembly of FIG. 1 is indicated generally at 10, and includes two principal components, a pipette body or suction device, indicated generally at 12, and a disposable tip 14. The suction device, as illustrated, includes a plunger 16 mounted within a cylindrical housing formed of three concentric tubular portions 18, 20 and 22, end portions of which are telescoped together. The tubular portions are preferably formed of plastic and are secured to each other in a conventional manner, such as by plastic "welding". The plunger is provided with a button end 24 which can be engaged by the thumb of the pipette operator. The upper end of the topmost tubular member 18 is provided with an apertured disk 26 which slidably receives an end portion of the plunger 16. A second disk 28 is secured to the end portion of the plunger 16 and is engaged at all times by one end of a compression spring 30 which normally biases the disk 28 into engagement with the apertured disk 26. A further apertured disk 32 is carried by the top end of the second tubular portion 20 and the spring 30 bears against this disk at all times, the plunger slidably passing through the aperture in this disk.

A piston 34 is carried by the tubular portion 22 and is formed with a very small diameter passageway which snugly receives a piston rod 36 in the form of a wire. The wire is secured to the lower end of the plunger 16 for movement therewith. The wire 36 is formed of a stainless steel, or of other suitable material. The piston 36 may be formed of stainless steel or other suitable material.

Mounted on the lower end of the piston 36, which extends beyond the tubular portion 22, is a receiver 38. The receiver 38 has an upper cylindrical portion 38.1 and a lower cone or funnel shaped portion 38.2 which acts as a

female tip receiver of the suction device, and which snugly receives the male disposable pipette tip 14.

5 The male disposable pipette tip 14 consists of a length of tubular material. The tubing is preferably extruded Teflon® tubing, which has a characteristic of being hydrophobic, although other hydrophobic materials may be used. In the illustrated embodiment the extruded Teflon® tubing has an i.d. of 0.3 mm. This material is relatively inexpensive and can be easily cut to the desired length. Also, it is readily available, and has relatively uniform inside and outside diameters. In addition, as the material is deformable to a limited extent, it can be easily inserted into the conical receiving portion or female tip receiver 38.2 of the suction device until it is firmly seated therein.

10 In operation, a length of extruded teflon tubing 14 will be cut from a supply of tubing and will be forced into the bell shaped tip receiver 38.2 until it is snugly seated therein. To take a sample, it is only necessary press the plunger down until the button 24 contacts the upper end 26, and to dip the end of the tip 14 into the sample. When the plunger is released, the sample will be drawn up into the disposable tip. In the illustrated embodiment, a 1.0 cm stroke of the plunger will produce a 0.5 μ l sample.

15 Because other sample sizes may be desired, the stroke of the plunger may be varied in any conventional manner. Alternatively, as the construction of the suction device is so inexpensive, it may be preferred to provide a plurality of suction devices for differing sample sizes. If this is the case, the suction devices may be color coded, or provided with other indicia so that the operator may know which size sample is to be collected with each suction device. A stand with a C-shaped clip may be provided, which clip is so sized that the barrel portion 20 may be slid into it.

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The pipette assembly of FIG. 5 also includes a disposable pipette tip 14 and a pipette body or suction device. The disposable pipette tip 14 is of the same construction as that shown in FIGS. 1-4 and described above. The suction device of this embodiment is functionally the same as the suction device 12 of the first embodiment, but is of a somewhat differing construction. Thus, in FIG. 1 a pipette body is illustrated which is formed principally of plastic parts, with the principal exceptions of the spring 30 and the wire 36 which forms the piston rod. However, in the device shown in FIGS. 5-7 the suction device, which is indicated generally at 52, is formed of a number of stainless steel parts. Thus the principal component is a stainless steel cylindrical barrel 54 which has press fit into one end a cylindrical member 56. The member 56 has a bore which slidably receives a cylindrical plunger 58 which has a cylindrical surface. The plunger carries another cylindrical member 60 which is press fit about the plunger, the cylindrical member 60 having an exterior cylindrical surface which is slidably received within the cylindrical bore of the barrel 54. A spring 62 is disposed between the two cylindrical members 56 and 60, and as can be seen from an inspection of FIG. 5, when the plunger 58 is moved in the direction of arrow 64, the spring will be compressed. To this end the plunger is provided with a button end 66, and the barrel 54 is provided with a threaded end which receives threaded guide 68. While not illustrated, it should be apparent that the threaded guide 68 may be of differing lengths to control maximum movement of the plunger 58. In addition, other methods may be employed for controlling maximum movement of the plunger, for example placing shims between the button end and the guide 68.

The end of the barrel 54 remote from the button end 66 of the plunger 58 is also threaded, and it receives an extension 70. The end of the extension 70 remote from the

threaded end receives a further support element 72 which may be force fit into the tip of the extension, or it may be glued in place. As can best be seen from FIG. 6 the extension 70 and the support element 72 receive a length of needle tubing 74, preferably 17 gauge. Disposed within the tubing 74 are a pair of polyethylene tubes 76, 78, the smaller tube 76 being telescoped within the other tube 78, the two tubes binding against each other. The larger diameter polyethylene tube is provided with a flared or bell shaped end 78.1 which may receive a disposable pipette tip. Thus, the flared end 78.1 is a female tip receiver which snugly receives the male disposable tip 14.

A piston rod in the form of a stainless steel wire 80 is carried at one end by the plunger 58. The other end of the wire 80 is closely received by the polyethylene tube 76 for sliding movement therein. Thus, the tube 76 acts as a cylinder and the wire 80 acts as a piston within the cylinder 76.

The manner of operation of this device is similar to that of the design shown in FIGS. 1-4. Thus, a suitable length of Teflon® tubing is cut off from a supply roll, and one end of the tubing 14 is snugly inserted into the bell-shaped outer end 78.1 of the tube 78 until it abuts against the inner tube 76 in the manner illustrated, the Teflon® tubing being frictionally or snugly held in place by the tubing 78. The plunger 58 will now be moved in the direction of arrow 64 until the button 66 contacts the guide 68. The tip 14 will now be placed in the liquid sample. The button end 66 of the plunger is now released, permitting the spring 62 to withdraw the plunger. As the diameter of the disposable tips are quite consistent, and as the stroke of the piston from fully extended position to the fully released position is always the same, very accurate small volumes in the range of 0.1 μ l to 2.0 μ l may be withdrawn.

While the best modes of this invention known to applicant at this time have been shown in the accompanying drawings and described in the accompanying text, it should be understood that applicant does not intend to be limited to the particular details illustrated in the accompanying drawings and described above. Thus, it is the desire of the inventor of the present invention that it be clearly understood that the embodiments of the invention, while preferred, can be readily changed and altered by one skilled in the art and that these embodiments are not to be limiting or constraining on the form or benefits of the invention.

What is claimed is:

1. A pipette assembly having a small volume disposable tip capable of taking very small samples in an accurate manner, the pipette assembly being of an inexpensive construction, the pipette assembly comprising:

- 5 a suction device having a female tip receiver for receiving disposable pipette tips; and
 a disposable pipette tip formed of extruded plastic tubing, the tubing being snugly received in the female tip receiver of the suction device.

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2. The pipette assembly as set forth in claim 1 wherein the extruded plastic material is formed of a hydrophobic material.

15 3. The pipette assembly as set forth in claim 2 wherein the hydrophobic material is Teflon®.

ABSTRACT OF THE DISCLOSURE

A pipette assembly (10) having a suction device (12 or 52) and a small volume disposable tip (14) having a capacity with a range of 0.1 μ l to 2.0 μ l, the disposable tip being removably secured to the suction device. The suction device is provided with a female tip receiver (38.2 or 78.1) which receives a disposable male tip (14). The tip is in the form of a short piece of extruded tubing. The tubing has a very small i.d., for example 0.3 mm. It is preferably formed of Teflon®, or another hydrophobic material.

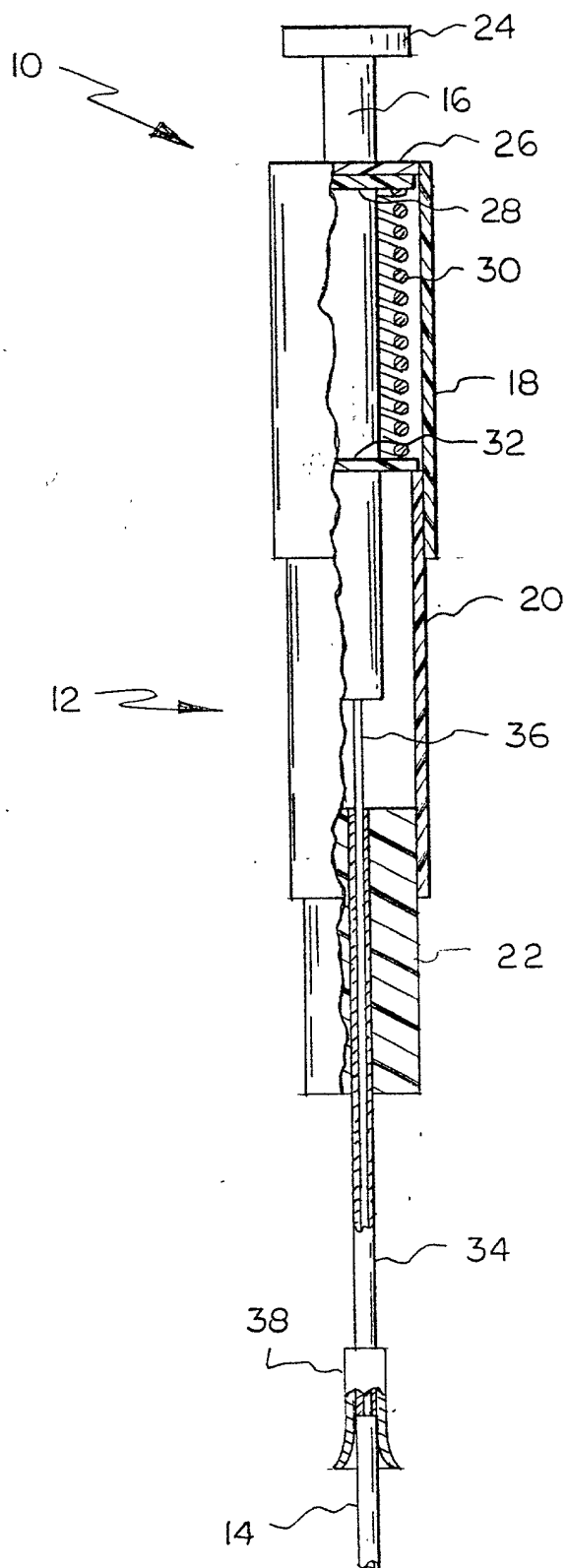


FIG. 1

FIG. 2

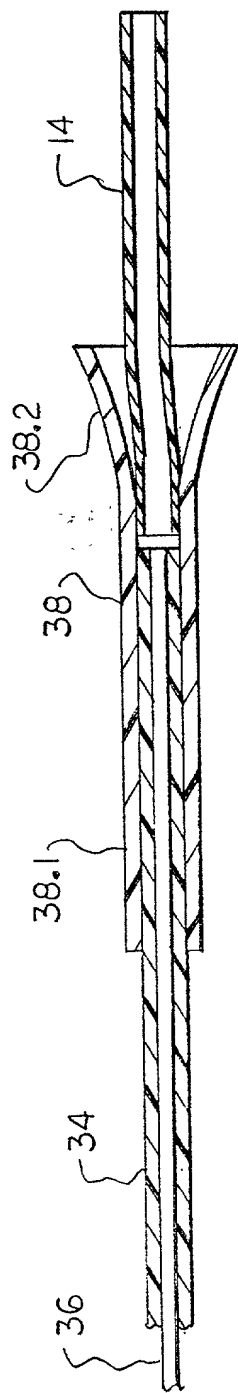
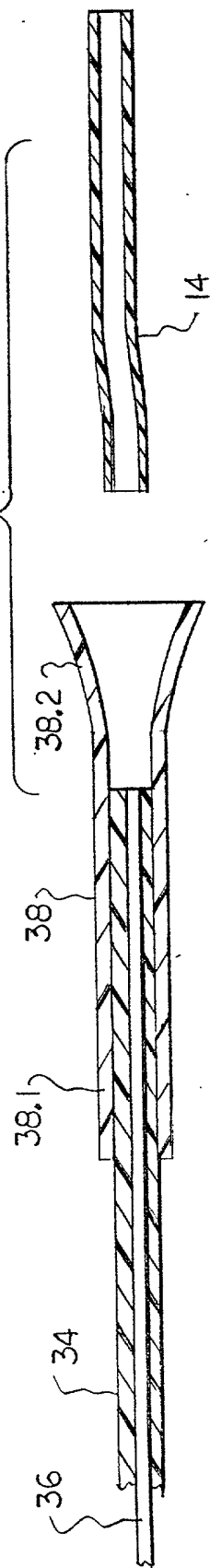


FIG. 3

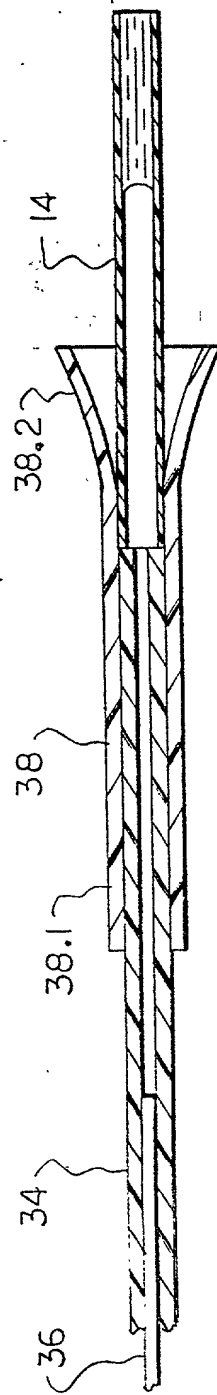
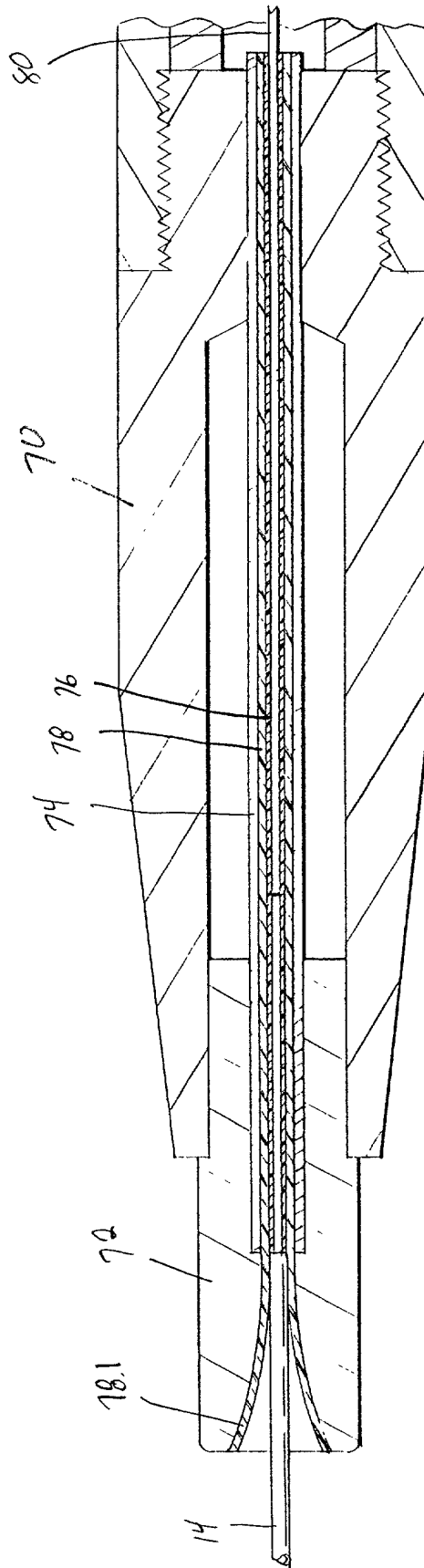
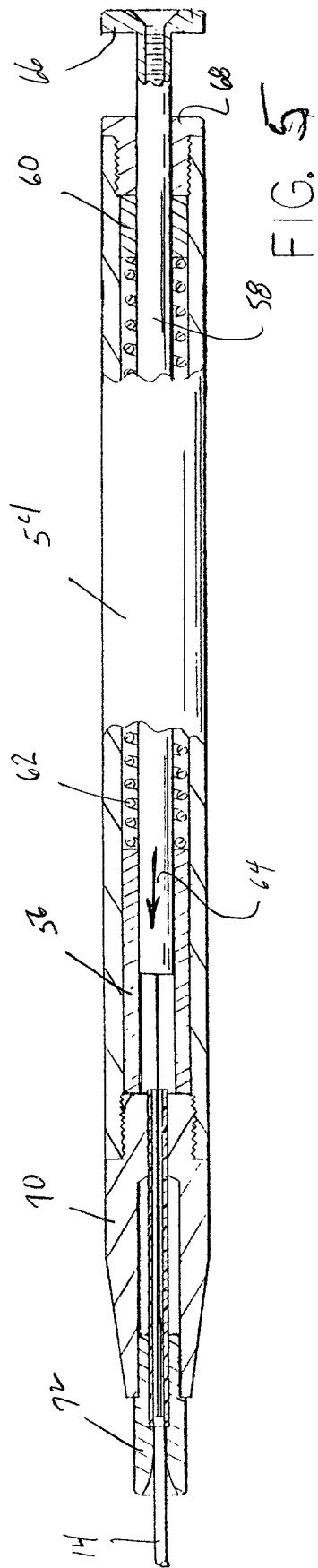


FIG. 4



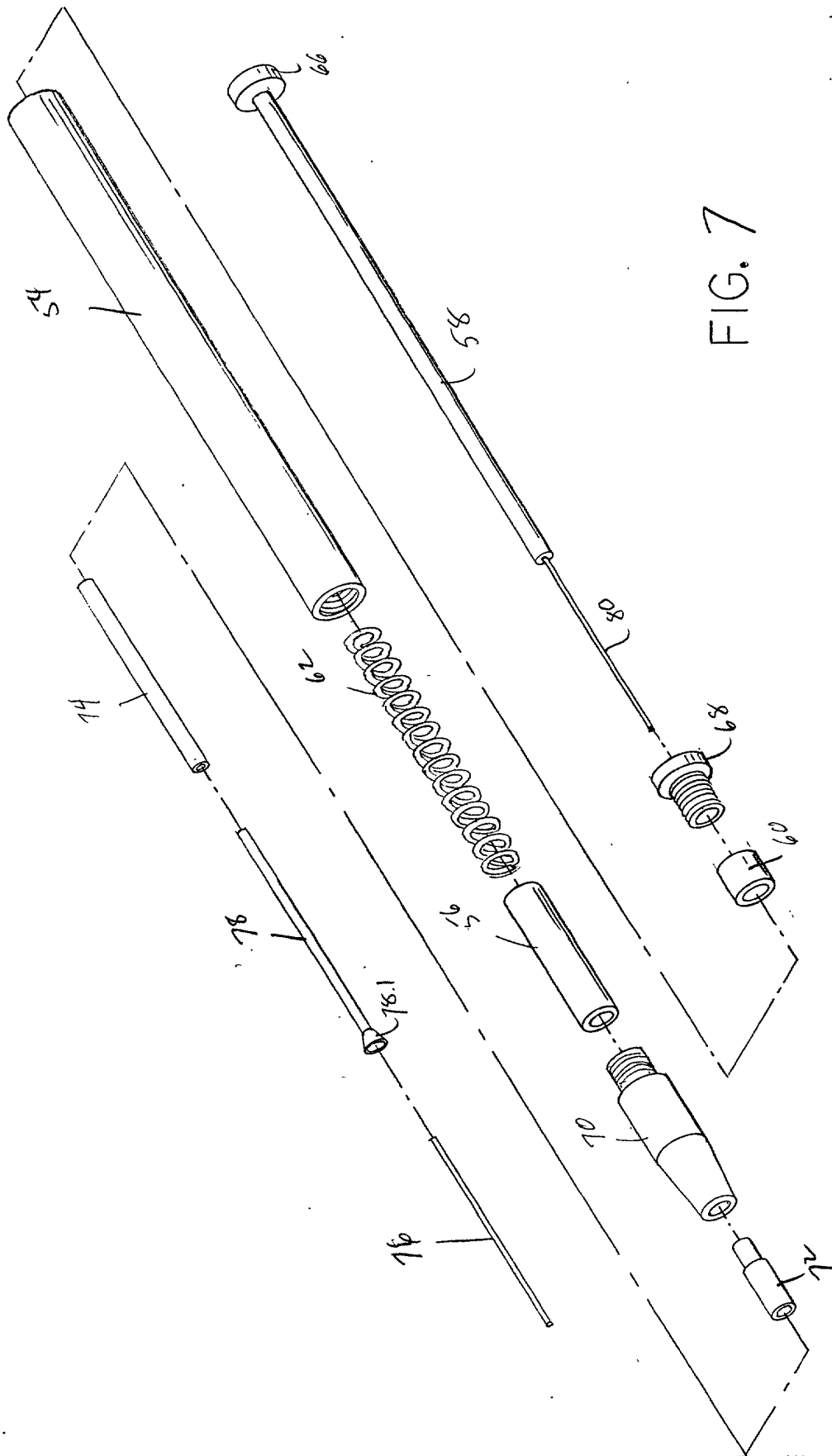


FIG. 7

Declaration and Power of Attorney for Patent Application

Attorneys Docket No. ENG901US

As a below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

PIPETTE HAVING A SMALL VOLUME DISPOSABLE TIP

the specification of which

☒ is attached hereto.

☐ was filed on _____

as U.S. Application No. or PCT International Application No. _____

and was amended on _____.

(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International Application which designated at least one country other than the United States of America, listed below, and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International Application having a filing date before that of the application on which priority is claimed:

Prior foreign applications

Priority claimed

_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/> Yes	<input type="checkbox"/> No

I hereby claim the benefits under 35 U.S.C. § 119(e) of any United States provisional application(s) for patent listed below:

60/141,981 (Application Number)	July 1, 1999 (Filing Date)
_____ (Application Number)	_____ (Filing Date)

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

_____	_____	_____
(Application Number)	(Filing Date)	(Status -- patented, pending, abandoned)

_____	_____	_____
(Application Number)	(Filing Date)	(Status -- patented, pending, abandoned)

As a named inventor I hereby appoint John C. Thompson, Reg. No. 20,253, my attorney with full power of substitution and revocation, to prosecute this application, to transact all business in the Patent and Trademark Office connected therewith, and to receive the Letters Patent.

Send correspondence to: John C. Thompson
69 Grayton Road
Tonawanda, NY 14150

Telephone number: (716) 832-9447 Facsimile number: (716) 832-9392

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

DATE

SIGNATURE OF INVENTOR

Goran E. Enhorning
Type or print inventor's name

21 Oakland Place
Mailing Address

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A citizen of Sweden